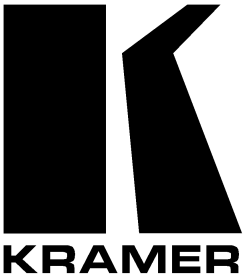
Kramer Electronics, Ltd.



USER MANUAL

Model:

FC-4002

Format Converter / TBC

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1 Introduction

Welcome to Kramer Electronics (since 1981): a world of unique, creative and affordable solutions to the infinite range of problems that confront the video, audio and presentation professional on a daily basis. In recent years, we have redesigned and upgraded most of our line, making the best even better! Our 500-plus different models now appear in 8 Groups[1], which are clearly defined by function.

Congratulations on purchasing your Kramer **FC-4002** *Format Converter / TBC*. This product is ideal for:

- Video broadcasting and editing studios
- All post-production uses
- Presentation applications for multi-format sources use

The package includes the following items:

- **FC-4002** *Format Converter / TBC*
- Power cord and Null-modem adapter
- This user manual[2]

2 Getting Started

We recommend that you:

- Unpack the equipment carefully and save the original box and packaging materials for possible future shipment
- Review the contents of this user manual
- Use Kramer high performance high resolution cables[3]

3 Overview

The Kramer **FC-4002** is a high performance format converter and TBC. In particular, the **FC-4002**:

- Accepts the following inputs[4]: Composite video, s-Video, and Component video (Y, B-Y, and R-Y; or RGB/S)

1 GROUP 1: Distribution Amplifiers; GROUP 2: Video and Audio Switchers, Matrix Switchers and Controllers; GROUP 3: Video, Audio, VGA/XGA Processors; GROUP 4: Interfaces and Sync Processors; GROUP 5: Twisted Pair Interfaces; GROUP 6: Accessories and Rack Adapters; GROUP 7: Scan Converters and Scalers; and GROUP 8: Cables and Connectors

2 Download up-to-date Kramer user manuals from the Internet at this URL: http://www.kramerelectronics.com

3 The complete list of Kramer cables is on our Web site at http://www.kramerelectronics.com

4 An input is selected by pressing the appropriate input selector button

- Has a looped Genlock input for synchronizing to an external source
- Has a highly stable internal generator for independent (non-genlocked) applications
- Outputs the Sync signal, and either: Component video (Y, B-Y, and R-Y; or RGBS), or when Component video is not selected, both Composite video and s-Video simultaneously, which is selected on dipswitches
- Lets you determine the output video standard (PAL B, PAL M, PAL N, NTSC 3.58, NTSC 4.43, and SECAM) via the dipswitches

Note, however, that the **FC-4002** does not convert between video standards.

In addition, the **FC-4002** features:

- Front panel buttons for input selection (CV, Y/C, YUV, and RGB/S), Genlock, freeze and panel lock
- Coarse trimmers and fine trimmers for adjusting the sync phase, and the horizontal-to-subcarrier phase (SCH)
- Control via the front panel buttons; and remotely, by RS-232 serial commands transmitted by a touch screen system, PC, or other serial controller

To achieve the best performance:

- Connect only good quality connection cables, thus avoiding interference, deterioration in signal quality due to poor matching, and elevated noise levels (often associated with low quality cables)
- Avoid interference from neighboring electrical appliances that may adversely influence signal quality and position your Kramer **FC-4002** away from moisture, excessive sunlight and dust

4 Your FC-4002 Format Converter / TBC

Figure 1, Table 1, and Table 2 define the **FC-4002** *Format Converter / TBC*.

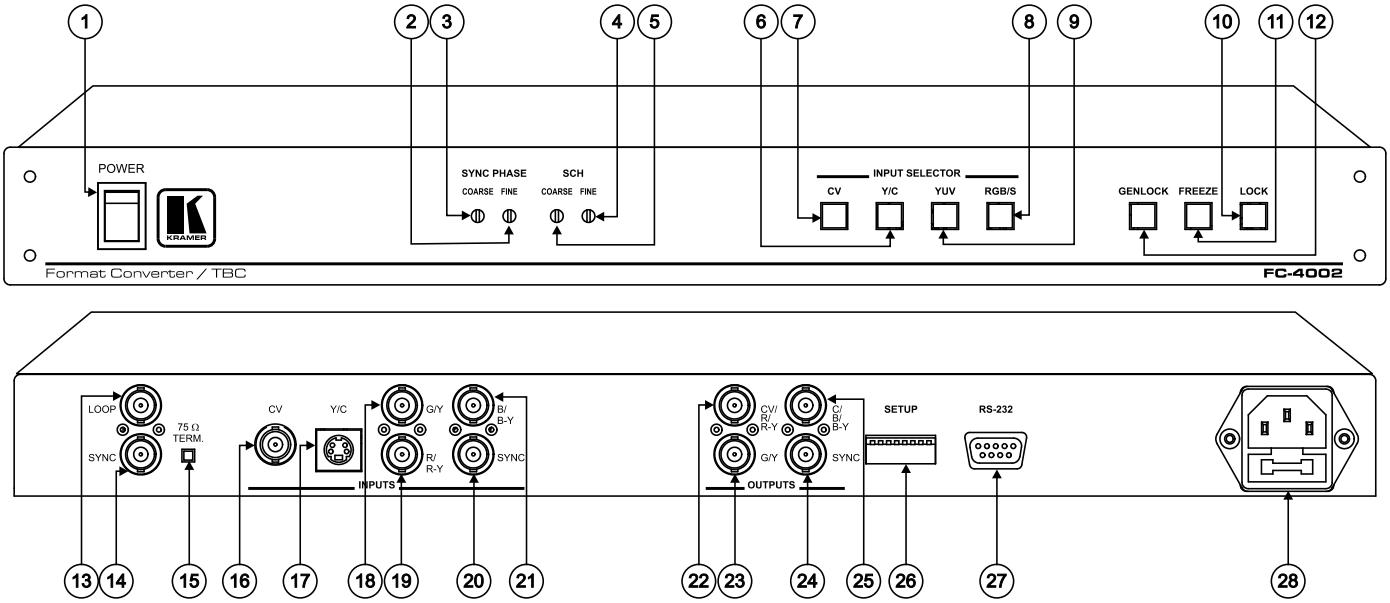


Figure 1: FC-4002 Format Converter / TBC

Table 1: Front Panel FC-4002 Format Converter / TBC

#	Feature		Function
1	*POWER* Switch		Illuminated switch for turning the unit ON or OFF
2	*SYNC PHASE*	*FINE* Trimmer	Adjusts[1] the sync phase level
3		*COARSE* Trimmer	
4	*SCH*	*FINE* Trimmer	Adjusts[1] the horizontal-to-subcarrier phase level
5		*COARSE* Trimmer	
6	*INPUT SELECTOR*	Y/C Button	Selects the s-Video source for conversion
7		CV Button	Selects the composite video source for conversion
8		RGB/S Button	Selects the RGB/S source for conversion
9		YUV Button	Selects the YUV source for conversion
10	*LOCK* Button[2]		Disengages the front panel buttons
11	*FREEZE* Button		Freezes the output video
12	*GENLOCK* Button		Press to enable GENLOCK operation

Table 2: Rear Panel FC-4002 Format Converter / TBC

#	Feature		Function
13	INPUTS	*LOOP* BNC Connector	Connects to the next Genlocked unit
14		*SYNC* BNC Connector	Connects to the Genlock source
15		Term Button	Press to terminate the Genlock source (75Ω) or release for looping[3]
16		*CV* BNC Connector	Connects to the composite video acceptor
17		*Y/C* 4p Connector	Connects to the s-Video (Y/C) acceptor
18		*G/Y* BNC Connector	Connects to the RGB (connect all 3 connectors: **R**/R-Y, **G**/Y, and **B**/B-Y), or YUV (connect all 3 connectors: R/**R-Y**, G/**Y**, and B/**B-Y**), or RGBS (connect all 4 connectors: **R**/R-Y, **G**/Y, and **B**/B-Y, and **SYNC**) video source
19		*R/R-Y* BNC Connector	
20		*SYNC* BNC Connector	
21		*B/B-Y BNC* Connector	
22	OUTPUTS	*CV/R/R-Y* BNC Connector	Connects to the RGB (connect all 3 connectors: CV/**R**/R-Y, **G**/Y, and C/**B**/B-Y), or YUV (connect all 3 connectors: CV/R/**R-Y**, G/**Y**, and C/B/**B-Y**), or RGBS (connect all 3 connectors: CV/**R**/R-Y, **G**/Y, and C/**B**/B-Y, and SYNC) video acceptor
23		*G/Y* BNC Connector	
24		*SYNC* BNC Connector	
25		*C/B/B-Y* BNC Connector	
26	*SETUP* Dipswitches		Dipswitches setup (see section 6.2)
27	*RS-232* Port		Connects to the PC or the Remote Controller
28	Power Connector with *Fuse*		AC connector enabling power supply to the unit

1 Insert a screwdriver into the small hole and carefully rotate it, trimming the level

2 Press for about 2 seconds to lock/unlock the panel

3 Push in to terminate the input. Release when the input extends to another unit

5 Installing on a Rack

This section describes what to do before installing on a rack and how to rack mount.

Before Installing on a Rack

Before installing on a rack, be sure that the environment is within the recommended range:	
Operating temperature range	+5 to +45 Deg. Centigrade
Operating humidity range	5 to 65 % RHL, non-condensing
Storage temperature range	-20 to +70 Deg. Centigrade
Storage humidity range	5 to 95% RHL, non-condensing

CAUTION!!

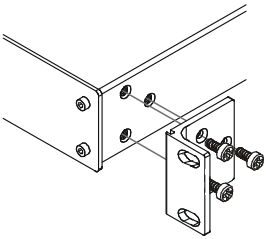
When installing on a 19" rack, avoid hazards by taking care that:

1. It is located within the recommended environmental conditions, as the operating ambient temperature of a closed or multi unit rack assembly may exceed the room ambient temperature.
2. Once rack mounted, enough air will still flow around the machine.
3. The machine is placed straight in the correct horizontal position.
4. You do not overload the circuit(s). When connecting the machine to the supply circuit, overloading the circuits might have a detrimental effect on overcurrent protection and supply wiring. Refer to the appropriate nameplate ratings for information. For example, for fuse replacement, see the value printed on the product label.
5. The machine is earthed (grounded) in a reliable way and is connected only to an electricity socket with grounding. Pay particular attention to supply connections other than direct connections to the branch circuit (for example, the use of power strips), and that you use only the power cord that is supplied with the machine.

How to Rack Mount

To rack-mount the machine:

1. Attach both ear brackets to the machine. To do so, remove the screws from each side of the machine (3 on each side), and replace those screws through the ear brackets.



2. Place the ears of the machine against the rack rails, and insert the proper screws (not provided) through each of the four holes in the rack ears.

Note that:

- **In some models, the front panel may feature built-in rack ears**
- Detachable rack ears can be removed for desktop use
- Always mount the machine in the rack before you attach any cables or connect the machine to the power
- If you are using a Kramer rack adapter kit (for a machine that is not 19"), see the Rack Adapters user manual for installation instructions (you can download it at: http://www.kramerelectronics.com)

6 Connecting Your FC-4002 Format Converter / TBC

You can use your **FC-4002** to convert a composite video, s-Video, or component video (YUV or RGB/S) signal to either: Component video, **or** Composite video **and**[1] s-Video simultaneously. For example, as the illustration in Figure 3 shows, an RGBS output[2] that connects to a plasma display.

To connect the **FC-4002** *Format Converter / TBC*, do the following[3]:

1. Connect the following sources to the **FC-4002**, the:
   - Composite video source (for example, a composite video player) to the CV INPUT BNC connector
   - s-Video source (for example, an s-Video player) to the Y/C INPUT 4p connector
2. Connect the component video INPUT BNC connectors, G/Y, B/B-Y, and R/R-Y to either a YUV or an RGB video source, as follows:
   - A Betacam video player to R/**R-Y**, G/**Y**, and B/**B-Y**, **or**
   - A camera (RGBS) source to **R**/R-Y, **G**/Y, and **B**/B-Y and **S**YNC
3. Connect the four BNC OUTPUT connectors: CV/**R**/R-Y, **G**/Y, and C/**B**/B-Y, and **S**YNC to a video acceptor (for example, a plasma display).
4. Connect the LOOP BNC connector to the next **FC-4002** Genlocked unit (if required) and release the Term button for looping[4].
5. Connect a Genlock source to the SYNC BNC connector.
6. Connect a PC or other controller, if required (see section 6.1).
7. Set the dipswitches (see section 6.2).
8. Connect the power cord[5] (not illustrated in Figure 3).

You can operate the **FC-4002** *Format Converter / TBC* via the front panel buttons and/or RS-232 serial commands.

1 When only one output is required, connect that output of the FC-4002, and leave the other outputs unconnected

2 Alternatively, you could connect composite video or s-Video or component video (Y, B-Y, and R-Y, or RGB)

3 Switch OFF the power on each device before connecting it to your FC-4002. After connecting your FC-4002, switch on its power and then switch on the power on each device

4 Pushed in terminates the input. Release when the input extends to another unit

5 We recommend that you use only the power cord that is supplied with this machine

6.1 Connecting a PC

To connect a PC to the **FC-4002** unit, using the Null-modem adapter provided with the machine (recommended):

- Connect the RS-232 DB9 rear panel port on the **FC-4002** unit to the Null-modem adapter and connect the Null-modem adapter with a 9 wire flat cable to the RS-232 DB9 port on your PC

Alternatively, to connect a PC to the **FC-4002** unit without using a Null-modem adapter:

- Connect the RS-232 DB9 port on your PC to the RS-232 DB9 rear panel port on the **FC-4002** unit, as Figure 2 illustrates

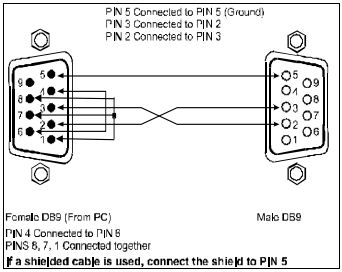

PIN 5 Connected to PIN 5 (Ground)
PIN 3 Connected to PIN 2
PIN 2 Connected to PIN 3
Female DB9 (From PC)
Male DB9
PIN 4 Connected to PIN 6
PINS 8, 7, 1 Connected together
If a shielded cable is used, connect the shield to PIN 5

Figure 2: Connecting a PC without using a Null-modem Adapter

6.2 Dipswitch Settings

The **FC-4002** dipswitch settings are defined in Table 3, Table 4, and Table 5:

Table 3: Output Standard Settings

FUNCTION	DIP 1	DIP 2	DIP 3
SECAM with 9H ID	OFF	OFF	OFF
SECAM	ON	OFF	OFF
PAL	OFF	ON	OFF
PAL N	ON	ON	OFF
NTSC 3	OFF	OFF	ON
NTSC 4	ON	OFF	ON
PAL M	OFF	ON	ON
Same as the Input Standard	ON	ON	ON

Table 4: Output Format Settings

FUNCTION	DIP 6	DIP 7	DIP 8
CV	OFF	OFF	OFF
CV with Pedestal	OFF	OFF	ON
Y/C	OFF	OFF	OFF
Y/C with Pedestal	OFF	OFF	ON
YUV	OFF	ON	OFF
RGB	ON	ON	OFF
RGBS	Any Value	ON	ON

Table 5: Dipswitch Settings (DIP 4 and DIP 5)

Dipswitch		Set as follows:
4	AGC	ON for enabling automatic gain control; OFF for disabling automatic gain control
5	75% Bar Generator	ON for enabling 75% Bar Generator; OFF for disabling 75% Bar Generator

The example in Figure 3 illustrates how to connect your **FC-4002**:

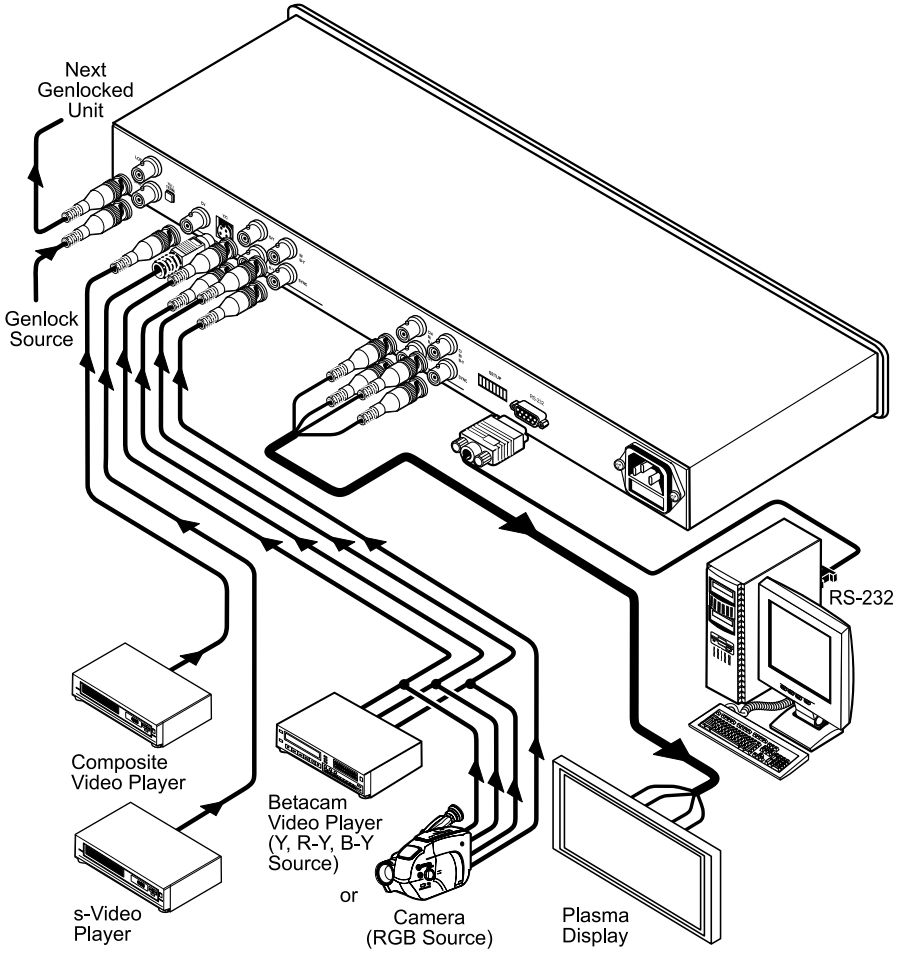


Figure 3: Connecting the FC-4002 Format Converter / TBC

7 Technical Specifications

Table 6 includes the technical specifications:

Table 6: Technical Specifications[1] *of the FC-4002 Format Converter / TBC*

INPUTS:	1 composite video - 1 Vpp / 75Ω on a BNC connector 1 YC - 1 Vpp/75Ω (Y), 0.3Vpp/75Ω on a 4p connector 1 component - Y/R-Y/B-Y (1Vpp/0.7Vpp/0.7Vpp) /75Ω (or RGB/S) on BNC connectors 1 SYNC (Genlock): Looped 75Ω / Hi-Z on BNC connectors
OUTPUTS:	1 composite video on a BNC connector 1 Vpp/75Ω 1 YC video on 2 BNC connectors: Y 1 Vpp/75Ω, and C 0.3Vpp/75Ω 1 component or RGB/S video on BNC connectors 1Vpp/0.7Vpp/0.7Vpp/75Ω 1 SYNC on a BNC connector
VIDEO STANDARDS:	PAL-B/D/G/H/I/M/N, NTSC-3.58/4.43, SECAM
DIGITAL RESOLUTION:	10 bits
BANDWIDTH (-3dB):	0.5dB to 5MHz, Fully Loaded
DIFF. GAIN:	1%
DIFF. PHASE:	1%
K-FACTOR:	1%
S/N RATIO:	63dB
LUMA NON-LINEARITY:	1%
CHROMA / LUMA DELAY:	1ns
CONTROLS:	Front-panel and RS-232; SCH phase, SYNC phase, H shift, freeze, panel lock
POWER SOURCE:	100-240VAC, 50/60Hz, 14VA
DIMENSIONS:	19 inch (W), 7 inch (D), 1U (H) rack mountable
WEIGHT:	2.6 kg. (5.7 lbs.) approx.
ACCESSORIES:	Power cord, Null-modem Adapter

8 Communication Protocol

RS-232 communication between the **FC-4002** and the PC is performed using this protocol (VER-0.1), which uses four bytes of information, and data is at 9600 baud, no parity, 8 data bits and 1 stop bit.

The controller and the machine should be connected via a null-modem connection, that is, if using a DB-9 port, connect PIN 5 of the PC to PIN 5 of the machine, cross PINs 2 and 3, that is, connect PIN 2 of the PC to PIN 3 of the machine, and connect PIN 3 of the PC to PIN 2 of the machine. On the PC side, short PINs 4 and 6, and short PINs 1, 7 and 8. This protocol complements Kramer's "Protocol 2000" (Kramer's switcher protocol), that is, the two protocols can co-exist without disturbing one another (according to Protocol 2000's definitions, the **FC-4002** would be machine number 24).

1 Specifications are subject to change without notice

Table 7: Structure of the Protocol

MSB							LSB
		INSTRUCTION					
0	TO PC	I5	I4	I3	I2	I1	I0
7	6	5	4	3	2	1	0
1st byte							
	DATA						
1	D6	D5	D4	D3	D2	D1	D0
7	6	5	4	3	2	1	0
2nd byte							
	EXTENDED DATA						
1	E6	E5	E4	E3	E2	E1	E0
7	6	5	4	3	2	1	0
3rd byte							
	MSB's		**ADDR**				
1	E7	D7	1	1	0	0	0
7	6	5	4	3	2	1	0
4th byte							

Note that the MSB's of the DATA (D7) and the EXTENDED DATA (E7) are in the fourth byte.

Terminology:
- TO PC is the "DESTINATION BIT"
- I4..I0 is the "INSTRUCTION"
- D7..D0 is the "DATA"
- E7..E0 is the "EXTENDED DATA"

The destination bit, TO PC, is 0 when sending from the PC to the machine, or 1 when sending from the machine to the PC.

Table 8: Instruction Set

#	INSTRUCTION	I5	I4	I3	I2	I1	I0
0	Reset	0	0	0	0	0	0
16	Error	0	1	0	0	0	0
32	Read front-panel switch data	1	0	0	0	0	0
33	Write front-panel switch data	1	0	0	0	0	1
61	Identify machine	1	1	1	1	0	1

DESCRIPTION OF INSTRUCTIONS

INSTRUCTION 0 – RESET
DATA=0: initialize the machine.
When the machine is initialized, it will send the RESET code (DATA = 0). If the machine receives this code, it will reset to its "power-up" state.
DATA=1: configure the machine to its factory default state.
When the machine receives this code, all programmable parameters will be reset to their factory-default values.
EXTENDED DATA - set as 0.

INSTRUCTION 16 – ERROR
If the machine receives an invalid instruction, it replies by sending this error code.

INSTRUCTION 32 – READ FRONT-PANEL SWITCH DATA
When sending to machine:- DATA = front-panel switch number; EXTENDED DATA - set as 0.
When replying:- DATA = front-panel switch number; EXTENDED DATA = front-panel switch value + 128.
The PC sends this instruction to the machine. The machine replies by sending back a value which relates to that switch.

INSTRUCTION 33 – WRITE FRONT-PANEL SWITCH DATA
DATA = front-panel switch number; EXTENDED DATA = front-panel switch value.
- The PC sends a value directly to the machine. If valid, the machine implements this new value, and replies by sending the same data back to the PC. Note that the addressed front-panel switch does not need to be pressed in order to change its value via RS-232.
- If the "+" or "-" button is pressed on the machine, resulting in a change in a switch value, then this switch number and value is sent to the PC.

INSTRUCTION 61 – IDENTIFY MACHINE
For sending, DATA = 3 to request software version number. EXTENDED DATA - set to 0.
The PC sends this instruction to the machine. The machine replies as follows:
- If the software version is requested, the machine replies with DATA as the version number before the decimal point, and EXTENDED DATA is the value following the decimal point. For example, for version 3.4, the machine replies with DATA = 03 (hex), and EXTENDED DATA = 04 (hex).

FRONT-PANEL SWITCH DATA

INPUT SWITCH
The value of the switch data for the INPUT switch is defined as:
0 = CV
1 = YC
2 = YUV
3 = RGB/S
4 = SDI (**FC-4001** only)

GENLOCK SWITCH
The value of the switch data for the GENLOCK switch is defined as:
1 = Machine is in Genlock mode.
0 = Machine is not in Genlock mode.

GENLOCK_STAT SWITCH (inner switch, not on front panel)
The value of the switch data for the GENLOCK_STAT switch is defined, when GENLOCK is ON, as:
1 = Machine is Genlocked to input.
0 = Machine is not Genlocked to input.

PANEL_LOCK SWITCH
The value of the switch data for the PANEL_LOCK switch is defined as:
1 = Machine's front panel is locked.
0 = Machine's front panel isn't locked.

FREEZE_SWITCH
The value of the switch data for the FREEZE switch is defined as:
1 = Freeze is ON.
0 = Freeze is OFF.

Table 9 contains the front-panel switch numbers, as defined for this protocol, and indicates the information which may be read (status, data) on each switch:

Table 9: Front-Panel Switch Numbers

SWITCH	D4	D3	D2	D1	D0	STATUS	DATA
Select Input Format	0	0	0	0	0	NO	YES
Genlock	1	0	1	1	0	YES	NO
Panel lock	1	0	1	1	1	YES	NO
Freeze	1	1	0	1	0	YES	NO
Genlock Stat	1	1	1	0	0	YES	NO

LIMITED WARRANTY

Kramer Electronics (hereafter *Kramer*) warrants this product free from defects in material and workmanship under the following terms.

HOW LONG IS THE WARRANTY

Labor and parts are warranted for seven years from the date of the first customer purchase.

WHO IS PROTECTED?

Only the first purchase customer may enforce this warranty.

WHAT IS COVERED AND WHAT IS NOT COVERED

Except as below, this warranty covers all defects in material or workmanship in this product. The following are not covered by the warranty:

1. Any product which is not distributed by Kramer, or which is not purchased from an authorized Kramer dealer. If you are uncertain as to whether a dealer is authorized, please contact Kramer at one of the agents listed in the web site www.kramerelectronics.com.
2. Any product, on which the serial number has been defaced, modified or removed.
3. Damage, deterioration or malfunction resulting from:
   - i) Accident, misuse, abuse, neglect, fire, water, lightning or other acts of nature
   - ii) Product modification, or failure to follow instructions supplied with the product
   - iii) Repair or attempted repair by anyone not authorized by Kramer
   - iv) Any shipment of the product (claims must be presented to the carrier)
   - v) Removal or installation of the product
   - vi) Any other cause, which does not relate to a product defect
   - vii) Cartons, equipment enclosures, cables or accessories used in conjunction with the product

WHAT WE WILL PAY FOR AND WHAT WE WILL NOT PAY FOR

We will pay labor and material expenses for covered items. We will not pay for the following:

1. Removal or installations charges.
2. Costs of initial technical adjustments (set-up), including adjustment of user controls or programming. These costs are the responsibility of the Kramer dealer from whom the product was purchased.
3. Shipping charges.

HOW YOU CAN GET WARRANTY SERVICE

1. To obtain service on you product, you must take or ship it prepaid to any authorized Kramer service center.
2. Whenever warranty service is required, the original dated invoice (or a copy) must be presented as proof of warranty coverage, and should be included in any shipment of the product. Please also include in any mailing a contact name, company, address, and a description of the problem(s).
3. For the name of the nearest Kramer authorized service center, consult your authorized dealer.

LIMITATION OF IMPLIED WARRANTIES

All implied warranties, including warranties of merchantability and fitness for a particular purpose, are limited in duration to the length of this warranty.

EXCLUSION OF DAMAGES

The liability of Kramer for any effective products is limited to the repair or replacement of the product at our option. Kramer shall not be liable for:

1. Damage to other property caused by defects in this product, damages based upon inconvenience, loss of use of the product, loss of time, commercial loss; or:
2. Any other damages, whether incidental, consequential or otherwise. Some countries may not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights, which vary from place to place.
NOTE: All products returned to Kramer for service must have prior approval. This may be obtained from your dealer.
This equipment has been tested to determine compliance with the requirements of:

EN-50081:	"Electromagnetic compatibility (EMC); generic emission standard. Part 1: Residential, commercial and light industry"
EN-50082:	"Electromagnetic compatibility (EMC) generic immunity standard. Part 1: Residential, commercial and light industry environment".
CFR-47:	FCC Rules and Regulations: Part 15: "Radio frequency devices Subpart B – Unintentional radiators"

CAUTION!

- Servicing the machines can only be done by an authorized Kramer technician. Any user who makes changes or modifications to the unit without the expressed approval of the manufacturer will void user authority to operate the equipment.
- Use the supplied DC power supply to feed power to the machine.
- Please use recommended interconnection cables to connect the machine to other components.

For the latest information on our products and a list of Kramer distributors, visit our Web site: www.kramerelectronics.com, where updates to this user manual may be found.
We welcome your questions, comments and feedback.

Safety Warning:
Disconnect the unit from the power supply before opening/servicing.

Kramer Electronics, Ltd.
Web site: www.kramerelectronics.com
E-mail: info@kramerel.com
P/N: 2900-000116 REV 2